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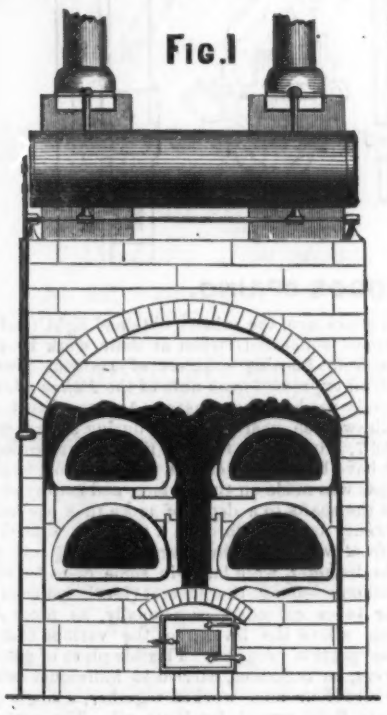
Curley's Improved Gas Retort Settings.

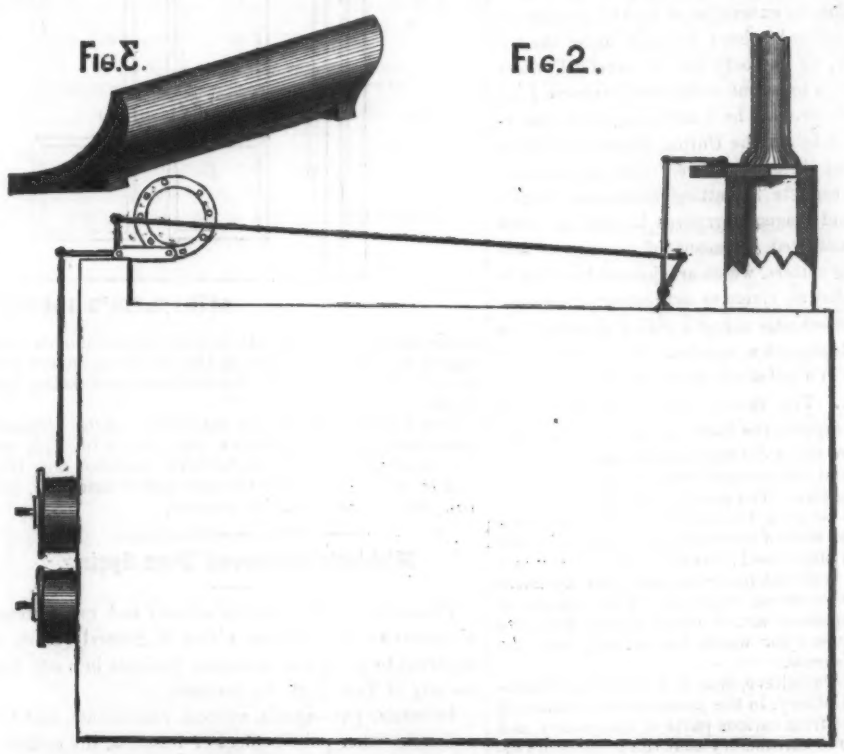
Mr. Thomas Curley, of Wilmington, Del., a gas engineer of much experience and practical ability, has for several years given his attention to the unequal durability of portions of gas retorts, and has recently taken out letters patent, through our agency, for a method of remedying this really crying evil.

It is very unpleasent, to say the least, for managers to have to witness the destruction of benches which should last at least two years, subject to the highest temperature of heat, destroyed in less than one half the time; for their destruction is not the result of detoriation in their manufacture, but in their unguarded setting, the very high heat maintained, and the sudden chilling during the clinkering process.

Every intelligent manager knows that to work benches profitably it is of the first requisite to maintain a high uniform heat, and the Directors will not be slow to perceive the consequent increase in profits accruing therefrom. Such a temperature should be mainained as will produce from a bench of fives, say 12 by 20 and 8 feet long, at least from 25,000 to 30,000 cubic feet of gas per diem. Now to produce the above results and maintain the retorts in good working order, at least double as long as it is possible to maintain them with the present settings and arrangements in general use, has been the object of this improvement, and the results have been more than was anticipated.

It is the general practice in works to clinker every morning and night; in doing so it is necessary for the stoker to rid his furnace of its fire in order that he may cut off the clinkers from its sides and rear end. During the operation of which there is a vast current of cold air passing through the bench, which quickly begins to tell on the retorts by their cooling and contraction. The stoker is the first who is made cognizant of its first effect in the chilling of the clinker which he is cutting, and which renders it more difficult to cut, and prolongs the operation. During all this time and until the coke is again ignited from the sides of the furnace (the furnace in the mean time having lost very considerable of its heat), the temperature of the retorts has decreased from that of a white to one approaching a dark color, and not for a very considerable time will they again recover their lost temperature and the oven its full heat. To this cause is mainly due the rapid destruction of the retorts, particularly the sides next the furnace, for no material will long withstand the sudden and rapid changes of temperature which a bench of retorts worked at a high heat are subject to under their present arrangement; they are also subject to an uneven contraction, for while the outside is contracting rapidly the inside is not affected on account of the hot coke within it. The sides of the middle retorts next the furnace are subject to the greatest intensity of the heat, and in time harden and lose their porosity; they are also more sensibly affected by the changes of temperature consequent on the clinkering, the negligence of the men in charge or from any other cause. Now to protect and strengthen the sides of the middle retorts from the direct action of the fire, to prevent the admission of any cold air during the time of clinkering, and to maintain a high and uniform heat in the oven is the great desideratum sought after at the present time and which the patent tile and independ-





CURLEY'S IMPROVED GAS RETORT SETTINGS.

ent damper more than accomplishes. The following advantages are claimed by the inventor for the "Shield Tile and Independent Damper":

1st. The shielding of the sides of middle retorts next the furnace from the destructive action of the fire at that particular point.

2nd. The retention of the even temperature of the oven during the time of clinkering, thereby preventing the loss of heat to the retort and oven.

3rd. The impossibility of cold air passing through the bench during the time of clinkering, and the consequent improbability of any contraction or cracking of the retorts

4th. The indefinite length of time the retorts may last, being protected alike from the severity of the flame and the chilling effects of cold drafts.

5th. The carbonizing of more coal with the same fuel than any similar-sized retorts will do in the United States set and managed as is generally now adopted.

6th. The unerring certainty of lasting at least twice as long in good running order as any other bench set and managed in the general way, the heats being equal.

7th. The saving to gas companies of at least one half the present yearly expense of new benches, and a considerable saving in the matter of leakage.

8th. The comparative short time it takes to clinker, on account of the clinkers not getting chilled, and the rapidity with which the coke is again ignited.

The accompanying illustrations will give the intelligent gas engineer and reader a clear idea of this important improvement. Figure 1 is a front view of a bench of retorts, showing the position of the "Shield Tile" in connection with the upper retorts. Fig. 3 shows the "Shield Tile" by itself.

The Independent Damper is simply a movable damper placed in the flue, over or near the stationary damper, and is arranged with levers and bell-cranks, ending in a handle at the side of the furnace, whereby the workmen can readily close or open the flue at pleasure. This admits of completely retaining the heat and preventing the ingoing draft of cold air during the process of clinkering. Figs. 1 and 2 show plainly the damper and connections, without any further explanation.

For further information apply to the inventor, Thos. Curley, Wilmington, Del., or M. L. Callender, at the office of this Journal.

Machines for Excavating Coal.

So far greater success has attended the invention of Mr. F. Hurd for the excavation of coal by machinery than any other which has been brought under the notice of the public, for not only has he received orders for several of them to be put down in collieries in Lancashire and Yorkshire, but he is arranging with gentlemen in France, Belgium, the United States, and other countries, to send them out there. The invention, it may be stated, consists in cutting horizontal, longitudinal, radial, and diagonal grooves in coal or other mineral to be excavated, by means of a series of link stocks containing cutters, which are jointed together in such a manner that no rivets or connecting pins are required. The cutters pass across a pulley mounted in a radial arm, and around a toothed wheel fitted to a shaft, which fits in a telescope frame to increase or reduce its length. The radial arm is provided with grooves, which support the back of the cutter stocks, and prevent them being drawn out in the groove of the radial arm; whilst the toothed wheel is driven to give motion to the cutters. The position of the radial arm is changed so as to give the required cut by a worm fixed to the outer shell of the telescope shaft, and a cam fixed to the driving wheel; the cam, by a lever and catch, turns the worm at intervals, and thus advances the cutters to the extent required. The machine is worked by compressed air, or other elastic fluid, the necessary machinery for which has already been described in the *Journal*.

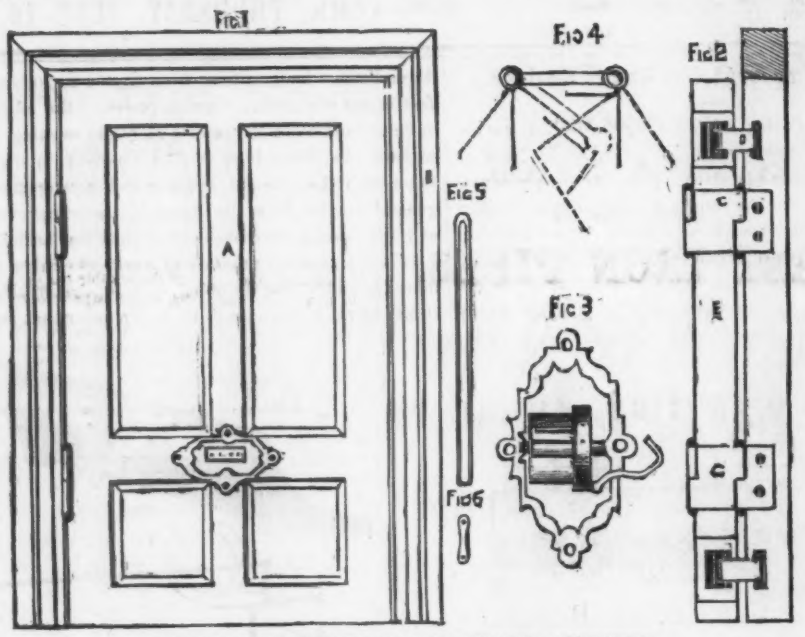
The machine, we believe, was first tested at Wharncliffe Silkstone Colliery, in the presence of a number of mining engineers from various parts of the country, and the results were so satisfactory that the proprietors ordered one without hesitation. Another trial was made at the Wombell Main Colliery, in the presence of one of the proprietors, himself a patentee of a mode of getting coal by machinery, and with equally satisfactory results. The machine itself weighs about 3 cwts., is made self-propelling, and can be adapted to work the thinnest possible seams. In several of the trials made in the first instance a bank four feet in length was cut to a depth of three feet in six and a-half minutes, the groove being one and a half inches. It will thus be seen that the machine, which is worked by one man, and clears away all the dirt as it goes along, will hole one and a-half ton of coal in about five minutes; but even that quantity will be exceeded by the double cylinder machines which are being made. There are three descriptions of machines—one for under-cutting, one for straight work, and a third to be worked by manual power, the latter, we believe, not weighing much more than ¼ cwt. We may also state that Mr. Hurd has disposed of one-half of his patent right for a considerable sum of money to a gentleman well acquainted with machinery for getting coal, and himself a patentee.

It would appear that the subject of raising coal and other minerals by machinery has attracted a good deal of attention abroad. From one place in particular, where, probably, a larger number of miners are employed than at any others on the Continent, and where much inconvenience has recently been experienced owing to strikes, a highly characteristic letter has been received by Mr. Hurd:

"*Le Creusot, Loire, Hotel du Commerce, April* 30, 1870.—Gentlemen: Having lately read something about your patent coal-cutting machine, I will be very glad to be favored by you with a few particulars, and if possible, with a small sketch. The matter is causing a good deal of excitement in France amongst mining engineers, and, perhaps, I can help to some orders.—P. Barbierre."

Similar letters have been received from Brazil and other places, including one from Mr. Elwell, Rue Moncey, Paris. Mr. Gemmell, of the Hampshire and Baltimore Colliery Company, Baltimore (U. S.), also enquires as to whether the machines would work a three-foot seam and a twelve-foot seam, with a view to having them put down. From the above facts it will be seen that the prospects of the patentees are in every way encouraging, and we expect on a future occasion to give a few particulars as to some improvements with regard to the introduction of the double cylinders, and the actual work done by the machines now being put down.

The terms on which the machines can be obtained are—under-cutting machines, 56*l*. 10s., with 1½d. per ton royalty; power straight-work machine, 60*l*. 10s., and 1s. per yard; and manual power machines, 25*l*. 10s., etc.—*London Mining Journal*.



MISHLER'S IMPROVED DOOR SPRING.

Mishler's Improved Door Spring.

The necessity of providing an easy and rapid means of ingress and egress from places of general resort, is apparent to every one who does business in a city like the city of New York, for instance.

In hotels, public halls, saloons, restaurants, and the numerous other public offices of business, the constant noise, clatter and banging of opening and shutting doors is a source of annoyance and inconvenience which is well known, and will be readily admitted without an argument here.

Many attempts have been made by inventors to devise mechanical apparatus, such as pulleys and weights and the like, to regulate the closing of doors, so as to avoid the evils just enumerated; but none of these devices seem to have been successful.

Mr. A. Mishler, of this city, has, however, recently secured a patent for an improved door spring, which it is believed meets all the requirements, inasmuch as it so governs the motion of a door either when opening or closing, that it is positively noiseless. The spring operates with a double hinge where necessary, so that the door can readily open from either way.

The accompanying illustrations will give the intelligent reader a clear idea of the operation of this improvement.

Fig. 1 shows the door closed in the usual manner, excepting it has no catch, it being held in place by the tension of the springs, fully shown in fig. 2. E is the inner edge of the door when standing fully open, exposing the double or universal hinge, c c, and elastic springs, F F. The form of this style of spring is shown at fig. 5, it being a double band of rubber. One end of this double band is thick, and is secured to a pin, fig. 6, which sits in a recess of the door frame. The other end is secured to a small spindle, or ratchet, like a miniature windlass, which is set into the door, near the centre of the panel. This device is better shown in fig. 3, and is intended to tighten the elastic band to a proper tension. At fig. 4 is shown the different positions of the universal hinge, with the door opened inwardly or outwardly.

The construction of this spring is simple and of little cost, and its operation with or without the universal hinge is very effective, and will be much employed when its utility becomes known.

For further information, address or apply to A. Mishler, Western Hotel, 9 Cortland St., N. Y.

Lighting Mines by Gas.—At the Royal Institution of Cornwall annual meeting, held recently, Mr. W. J. Henwood, the President, said that in Sweden at the beginning of the century, and in Himalaya some fifteen years ago, the miners obtained light, (and were sometimes suffocated) when at their work by smoky flames from burning splinters of resinous pine. In Brazil, oil expressed from nuts of the *Palma Christi*, is commonly used by the miners. An experiment, made at Balleswidden, near Penzance, during several months of 1856-7, attracted at the time much less attention than might have been expected, and is now almost forgotten. Coal gas was made on the surface, and conveyed down one of the shafts to a depth of more than one hundred and twenty fathoms, through a two-inch wrought-iron pipe, from which branches, varying from ¾ inch to one inch in diameter, were laid—in some cases for at least 170 fathoms—along the several (level) galleries; and similar tubes extended, occasionally, as much as ten fathoms above the levels, to the various (backs or pitches) parts in progress. Flexible pipes of gutta percha were, on occasions, carried to individual laborers, but where four men worked together, a single jet of gas gave light enough far them all. The captains of the mine reported that—"In the shaft, level and pitches it answered so exceedingly well as to leave no doubt of its serving all the purposes for which it was intended." It was computed that the works were lighted by gas one-third cheaper than by candles.

The purest iron ores in the world are said to be those found in the Huronian rocks of Northern Michigan. These ores exist in immense quantities, and the beds cover a large extent of country. They belong to the red hematite species, but are associated in some places with magnetite, and in others with limonite, a result of the secondary action of meteoric and drainage waters on the other species.

Chemical Repertory.--No. 32.

JUNE 16, 1870.

Editor—HENRY WURTZ.

SPECIAL EDITORIAL NOTE.

In consequence of repeated and annoying misapprehensions, it is necessary to repeat here the announcement (which has stood under the general editorial heading since my connection with the Journal, but has apparently escaped the notice of many), that I wholly repudiate responsibility for, and have even no necessary knowledge of, any thing that is not over or under my own name or initials.

HENRY WURTZ.

Editorial.

Our readers will of course be reminded by the extract given below of our own very recent labors in connection with the precisely similar well in Ontario county in this State (this Journal, vol. xii; pp. 82, 104 121), from which it is proposed to supply with gas the cities of Rochester and Lima, situated respectively nineteen and seven miles from the gas-well. A strong and rich company has now been formed to carry out this unprecedented project; unprecedented so far as the conveying of *natural* gas to such long distances is concerned; though it is not uncommon for coal-gas to be carried eight or ten miles successfully; as on this very Island of New York, by the HARLEM COMPANY, from Harlem to Kingsbridge; and in one or two places in England. If it has been found wholly practicable to convey coal gas, which is so readily condensable, to such distances, how much more so in case of these gases, which, as I have shown, are incondensable, and have moreover higher densities, and are therefore less liable to leakage. The local use of these natural gases (called objectionably "petroleum gas," in this extract) for calorific and steam, as well as illuminating purposes, in this country, has long been common; as at the *Burning Springs* in West Virginia, where many steam engines are stated to be run by the gas; as well as in a multitude of other places. These considerations open to us almost a new world of ideas. Gaseous fuel flows anywhere, if properly confined, up and down hill, for example, and can be moved with a rapidity, facility, convenience, and manageability, which must give it the preference, even at greater cost, over all other forms of fuel. But when, as in the case of these gas-wells, our fuel *raises itself out of the mine*, without current cost of production, the advantage is immensely increased. Gaseous Elasticity is a Miner who does not strike for higher wages. There seems to be in this direction a future before us whose possibilities may be the subject, when actually realized, of as much wonder as has been the history of American petroleum production. The economical purification from carbonic acid of these natural gases, together with their cheap transportation and confinement, and so on, furnish a class of scientific and practical problems, to some extent novel, and not less important relatively than those which have been connected with the general manipulation of petroleum. To these the undersigned, looking forward to the future that appears to him inevitable, has given much labor and study. To this subject we shall often recur.

HENRY WURTZ.

PETROLEUM GAS AS A FUEL.

The largest boilers at the Erie Water Works are now heated solely by the flow of natural gas from the well recently sunk there. This well is down five hundred and ten feet, and has cost $1,500. The gas is conducted by an inch-and-a-half pipe, without gasometer, through smaller pipes underneath the boilers. The flow has been steady, and less than one-half the amount has been necessary to keep up a pressure of forty-seven pounds of steam to the inch, the usual pressure required. No coal whatever has been used since its introduction, the cost it saves being from eight to ten dollars per day. Thus far it has only been conducted into the fire space under the boilers, but pipes will be put in to conduct it directly into the flues. Besides the saving of coal, the item of cleanliness is one worth taking into consideration. There is no smoke, no dust, no ashes, and nothing to do except turn a faucet to either shut off all heat or put on full force, in a twinkling. Added to the intrinsic value of this well, the success in finding gas has opened a new channel of prosperity, and several prospects and enterprises, wherein the cost of fuel is the great item of expense, and whereby it may be made almost nominal, are already on foot, and doubtless some of them will be pushed through to a fair trial. There is a plan talked of, says the *Dispatch*—and by men who generally mean business—to bore for gas in the edge of the bay, and use it in the manufacture of iron, thus doing away with the enormous cost of coal. The scheme looks like a wild one, but may be more practicable than the majority would consider it. A couple of gas wells at the water works would certainly be a great assistance in saving coal.—*Scientific American.*

SMOKE-CONSUMING FURNACES.

More than thirty years ago, Mr. C. WYE WILLIAMS took out a patent in England for this subject, but failed in his expectations of profit therefrom. Recent experiments in the British navy, however, on his plan; an extended account of which we find in the *London Mining Journal* of May 28th, 1870; show it to be of great value. There is a sort of cant very common among the large class in this, and all other countries, who are by nature opposed to all innovation and improvement, a class which includes even many scientists, or rather what may be designated as *scientific pessimists;* which is expressed by exclaiming of every new invention: "Oh, if it *has* merit, it will make its own way. Don't go into the water till you know how to swim." Such a case as we now refer to, is one of the legion that may be cited to confound these wiseacres. We copy one or two concluding paragraphs.—H. W.]

"In a trial in which both sets of furnaces were used, the coal burned being Ferndale and Cowpen's Hartley, in equal proportions, the report gave the smoke figures as 1.55 from the starboard, or new form of furnace, and 4.55 from the old furnaces. The new furnaces burnt 2940 lbs. of coal per hour, and produced 2314 lbs. of ash, 282 lbs. soot, 358 lbs of. clinker. The old furnaces burnt 3294.6 lbs. of coal per hour, and produced 3275 lbs. of ash, 516 lbs. of soot, and 250 lbs. of clinker.

"In the last two trials made, the new furnaces only were used on the former and the old furnaces only on the latter trial, the coal burnt in each instance being equal quantities of Powell's Duffryn and Cowpen's Hartley. In the first case, the new furnaces burnt 2912 lbs. of coal per hour, producing 1773 lbs. of ash, 194 lbs, of soot, and 310 lbs. of clinker. In the second case, the old furnaces burnt 3397.3 lbs. of coal per hour, producing 2434 lbs of ash, 406 lbs. of soot, and 406 lbs. of clinker. In these two trials the new furnaces exhibited a saving upon the old of 14.28 per cent. in fuel, an increase of 7.56 per cent. in horse-power, and a positive gain in the consumption of smoke of 21.84 per cent. A pyrometer is fitted in each funnel, at 6 feet above the uptake. In the funnel over the old furnaces the pyrometer indicated the heat of the escaping gases as high as 1600°. while in the funnel over the new furnaces the maximum height was but a little over 900°."

American Chemical News.

[*Original Communication.*]

PROFESSOR WALLING'S THIRD REJOINDER TO DR. VANDER WEYDE.

Professor HENRY WURTZ.

Dear Sir; It is very gratifying to me as it will doubtless be to your readers, to perceive that the long controversy, between DR. VANDER WEYDE and myself, approaches a close; as is indicated by the near approximation of ideas in our later communications.

We are now agreed hat something besides matter really exists; that force is something more than "*matter in motion*" something unknown and unfathomable, but still something which *causes* matter to move, and moreover that this force, whatever it may be, exists in large, nay, in infinite quantities, in what is termed a "latent" or "potential" state, where it does not cause matter to move at all, being therefore, "unperceived by the senses" and that this latent or potential force, is capable of manifesting itself, by producing motion, whenever the conditions become favorable for such manifestation.

We are farther agreed that every motion in the physical universe, is produced primarily by gravitation, that is, by that universal principle, by virtue of which all matter tends to approach all other matter.

Let us see what is the principle difference now remaining between us. The object of my original paper was to show that with the facts then claimed and now conceded, the theory of Conservation of Force could best be sustained, under the supposition that force exists in a free and independent condition, as well as associated with matter. I speak of the conservation of *force* and not of *actual energy* or motion, which even the Doctor now admits does not exist, and only claims that the sum of actual and potential energies is conserved.

Dr. VAN DER WEYDE prefers to maintain that force, instead of having an independent existence, is "*bottled up*," as it were, in some inexplicable manner, in the body or atom itself, where it has a wonderful sort of *discriminating power*, enabling it to discover the existence of, and precise direction to, another body, across a vacant space, and to cause that body to move towards itself, while at the same time the other body is equally active in causing the first to move towards it. Moreover, not only does each body or atom discern the *direction* of the other, but also the exact distance, and their mutual actions are nicely graduated in intensity to conform to the distance, in accordance with a law which cannot be reconciled with this hypothesis, by any supposition which is not unphilosophical and arbitrary.

The amount of potential force thus bottled up may vary in each atom, from zero to infinity, according to its position relative to any other atom. Like the genii of the vial in the Arabian Nights' Entertainments, this immense force is supposed to be alternately liberated and imprisoned, and it is only by including in the estimate of force belonging to any atom, the force which is still imprisoned within it as well as that which is liberated and active, that the theory of conservation can be maintained. Here it seems to me, is a conception far exceeding in wild improbability either ancient necromancy, Salem witchcraft, or "modern spiritualism." But I am not disposed to retort upon the Doctor the trivial imputation of a belief in such agencies, for I am as well aware of his disregard of them as he is of mine.

Whether he has any ideas or not as to the *cause* of such incredible operations, he does not make them known. He is content—nor is he alone in this respect—to accept the dogma that all matter *attracts* all other matter, a dogma expressly condemned by Sir ISAAC NEWTON himself, and by many leading physicists of the present day. So before the days of GALILEO and TORRICELLI atmospheric pressure was recognized, and philosophers were satisfied with the supposition that the piston of the pump *attracted* or *sucked up* the water, or that "nature abhorred a vacuum."

I am amused by the Doctor's strictures upon Sir JOHN HERSCHEL, whose acuteness in investigating, and clearness in presenting, his ideas upon scientific subjects are proverbial. Surely the Doctor cannot be ignorant of the law of dissipation of energy in collisions, and of course the same law must govern atoms if they are rigid bodies, transmitting motion to each other by actual collisions.

After carefully reading the Doctor's long communications, I fail to perceive that he has advanced any new argument to sustain his position, or to controvert mine, and I accordingly leave the subject here. I will say, however, before closing, that his imputation against me of borrowing my ideas from others is simply untrue. He attempts to sustain this charge by asserting that Professor NORTON claims my hypothesis, and cites his papers in *Silliman's Journal*, 1864–67, while a sketch of my notion was published in the same journal in 1865. I cannot think that Professor NORTON will make any such claim, as it will be found on reading his articles that in his ingeniously devised molecular theory he attributes gravitation, at least in those earlier papers, to a residual or resultant force, made up of compounded attractions and repulsions, and that it is only in a recent communication to *Silliman's Journal*, January, 1870, that he "*now* finds," etc. I recollect a conversation with him in 1865, when he, at my request, kindly perused a paper containing the views then presented by me, whereupon he remarked that they were novel and interesting, and recommended the publication of the paper.

But there is no similarity between the notions of Professor NORTON and myself, except in regard to the *interception* of force by matter. The recognition of this principle is included in his earlier papers, where it is made to account for some of the phenomena of crystallization.

I never before heard of the theory of "AZAIS;" but if Dr. VAN DER WEYDE describes it correctly it is, like Professor NORTON'S, a theory of universal repulsion and is entirely different from the one I have advanced. The ordinary conception of repulsion presents it as a "bottled up" force, acting outwardly from a centre, when partially liberated for that purpose, the difference between it and attraction being that by the latter action bodies are mutually pulled towards each other, and by the former pushed away from each other. Both conceptions are to my mind equally inexplicable and unphilosophical.

My notion is that *Universal Force* exists in an infinity of *straight lines*, occupying all space, and only producing material motion by the association of force with matter; an association which is a consequence of mutual interception. The motion which is a consequence of this association we call *gravitation*. That principle which is called *repulsion*, or the tendency of bodies to separate from each other, is simply a consequence of the law that bodies continue to move in the direction of the associated force, until that force is dissociated. In this manner centrifugal force tends to separate bodies, as when a comet recedes from the sun with the enormous velocity acquired in its approach. What was formerly called the repulsive force of heat is now shown to be simply the centrifugal force or momentum of the atoms. And so it happens that the Universal Force first causes bodies and atoms to approach, and then to recede from each other, in vibrations constituting an endless variety of different motions, and these motions make up the entire phenomena of the physical universe.

Yours respectfully,
H. F. Walling.

CHEMICAL EXCERPTA.

We gather from the *London Journal of Gas Lighting*, of May 24th, the following items of interest:

"The annual meeting of the British Association of Gas Managers is fixed for the 7th, 8th and 9th of June, which last-named day will be devoted to a visit to the Beckton Works. The programme promises to well sustain the interest of these meetings. A joint lecture will be given by Messrs. Kirkham and Sugg, 'On Photometry as applied to the Estimation of the Value of Coal Gases.' Mr. F. W. Hartley also promises some 'Remarks on Photometry,' and a paper by Mr. C. Heisch is announced 'On the Method of Testing the Illuminating Power of Gas, with special reference to Burners.' Practical papers 'On Setting and Working Retorts,' and 'On Charging and Discharging Retorts by means of Machinery,' are promised by Mr. Cathels and Mr. Somerville. Mr. Morton will introduce the subject of 'Sunday Labor in Gas-Works,' and Mr. Goddard will treat of 'The Application of Gas to the Generation of Steam.' Papers are also promised 'On Scrubbers,' 'The Manufacture of Tar Pavement,' 'On Stoppage in Ascension Pipes,' 'On Gas-meters,' 'On Artificial Alizarine,' and 'On a New Form of Gas-Exhauster.'"

"A lamentable accident, which illustrates at once the reckless carelessness and bravery of some men, has occurred at the Beckton Works. A well is being sunk there, and it might have been supposed that every man engaged in well-sinking would be aware of the danger there is of carbonic acid accumulating in the hole. Nevertheless, this knowledge—if he possessed it—did not deter a man from going down the well without first taking the common precaution of ascertaining whether the air was foul or not. Unfortunately it was foul, and he was soon overcome and fell. Another went to his rescue and immediately shared his fate. Then others went down, until at last there were seven senseless at the bottom; and only two were got up alive. We notice this accident more particularly to call attention to a very simple expedient adopted by Mr. Gossage, of Widnes, for displacing carbonic acid and admitting pure air to a well. He makes a bundle of straw of very nearly the same diameter as the hole, and by means of a rope lowers and raises the bundle several times, in that way, of course, expelling the foul air and replacing it with pure. This simple expedient cannot be made too widely known."

A correspondent informs us that the use of coke as fuel at the Dover Corporation Water Works has resulted in an economy of 315*l.* per annum, the cost of coal being 1,050*l.* as against 735*l.*, the cost of the coke. To make the comparison complete, the cost per ton of the coal and the coke should have been stated.

"We publish in this number a valuable paper by Professors Silliman and Wurtz 'On Flame Temperatures, in their Relations to Composition and Luminosity, in which they make some important corrections in Bunsen's method of calculating the temperatures of the combustion of gases. One merit of the paper, which which will be appreciated by many, is the substitution of arithmetical processes for the complex formulæ which perplex the non-mathematical reader of Bunsen. The practical conclusions arrived at by the authors have much interest, and their further investigations on the subject will be looked for with impatience."

Professor Roop's paper, "On a Photometer for Determining the Amount of Light Reflected from Metallic Surfaces at Different Incidences," will also be read with interest.

[Professor Roop's important paper, here given from the *American Journal of Science*, is not yet complete, and, besides, requires cuts for its illustration. Hence, we await another day to present it in complete and satisfactory form. H. W.]

A New Photometer.—A photometer, invented by M. Nagant, is based upon the formation of a column of liquid, partially opaque, which may be drawn out until the length is such that the light from an illuminating body ceases to be visible through the liquid. The length of the column which completely obscures the light, starting from the point where the column is thinnest, gives a measure of the intensity of the light under examination.

Revivification of the Oxides of Iron employed in Gas-Purifiers by means of Steam.—C. Mene.—From the author's description, it appears that, at the Vaise station of the Lyons Gas Works, the following process is applied for regenerating the oxide of iron. The oxide of iron, saturated with sulphur as it is taken from the purifiers, is placed in a tank made of iron, which, after having been filled, is hermetically sealed. A pipe from a steam-boiler admits steam in the middle or bottom of the tank, while at the top thereof another pipe leads into the chimney-stalk of the boiler-furnace, carrying off the sulphuretted hydrogen resulting from the action of the steam (low pressure) upon the sulphide of iron. Actual decomposition of water takes place in this process, its hydrogen combining with the sulphur, and its oxygen reproducing the peroxide of iron. The great advantage of this process is the very considerable saving of time and the space required for exposing the peroxide to the action of the air—a slow process.—*Chemical News.*

[This reads very apocryphally. That sulphides of iron are resolved by *highly heated* steam (without reference to pressure) into iron oxide and sulphuretted hydrogen, is a familiar fact, but that *low pressure* steam (even *wet*, as it would be in this case), should act thus powerfully, seems improbable. If so, however, why remove the fouled oxide from the purifiers at all? Why not let steam at once into the boxes and revivify therein? This would be a capital saving. It is to be feared, however, that the torrents of sulphuretted hydrogen thus engendered would be hard to deal with. H. W.]

Societé Chimique de Paris, March 4, 1870.

Maumene finds that when aniline and chloral react, a compound is formed ($C^{120}H^{5}NO^{4}$) which is a powerful base resembling in its characters ulmic acid. Its salts do not crystallize.—H. W.

Bourgoin gave an account of an accident in the preparation of oxygen at the *Hôtel Dieu*, of which we have had some obscure notices through the newspapers. He attributed it chiefly to the use of improper proportions of the mixture of chlorate of potash and peroxide of manganese used. Equal parts work regularly, but a mixture of the chlorate with but one half of manganese is liable to fuse and then give off oxygen with explosive suddenness. In discussion Debray recommended the use of the red oxide, instead of the black oxide of manganese.—H. W.]

Deterioration of Coal by Exposure to the Air.

Very few articles on this important subject have appeared in our scientific journals, and it is only within a few years that the attention of engineers has been called to the great loss suffered by coal from exposure in the open air. Recently a German chemist, Dr. E. Richters, has been studying the question, and has given the world the benefit of his observations. It appears that coal at ordinary temperatures, absorbs oxygen; and if it be heated to 300 degrees Fah., it at first increases in weight, carbonic acid and water are expelled, and oxygen and hydrogen are in the proper proportions to form water.

The carbon in the coal appears to be present in two modifications, one of which is not well understood, and is comprised under the general name of bitumen. The bitumen carbon is first oxidized, and the other modification is the last to be affected. The amount of hygroscopic water that the coal can absorb varies considerably, and does not appear to be dependent upon the structure of the coal. Solid coal absorbs, not unfrequently, three times as much water as a softer, more lamellar article.

The changes that take place in the coal are naturally more rapid in the earlier stages of its exposure than at a later period, but the absorption of oxygen does not cease at any time. If a current of air is passing over a coal heap, large quantities of carbonic acid will be given off; but where the air is quiet, the coal absorbs the carbonic acid and less change is manifest. According to this, on windy days the loss in the weight of coal must be greater than when the weather is calm.

The temperature of the air has much to do with the deterioration of coal, as warm weather greatly promotes the absorption of oxygen and the formation of carbonic acid. All engineers agree that the influence of moisture is very great. Water operates in various ways; it acts upon the iron pyrites, that in greater or less quantity accompanies all coal, oxidizes the iron, slakes the coal, and thus exposes greater surface to the action of the air, and heats up the mass, so as to promote oxidation. The sulphate of iron in turn oxidizes, and is again reduced by the coal; and it is thought that the green vitriol thus serves as a conveyancer of oxygen to the coal, and occasions its combustion. This fact has been overlooked in accounting for the large loss in the value of coal.

Whether sunlight has any influence upon the decomposition and oxidation of coal is uncertain. All of the observations were contradictory, but perhaps a majority of them authorize the conclusion that sunlight prevents the destruction of coal.

The spontaneous combustion of coal is a matter of great importance, and has been the special object of study, but it is difficult to give a satisfactory explanation of it. By some observers it is attributed to a species of molding, such as moist hay undergoes, thus giving rise to sufficient heat to ignite the mass; others assign great influence to the decomposition of iron pyrites, but a closer study of the subject has shown that 160 deg. F. is the utmost that can be anticipated from this cause.

The most rational explanation appears to be the absorption of oxygen and the rapid oxidation of the carbon—the more rapid the oxidation the greater the increase of heat, until a temperature is reached that sets fire to the heap of coal. The conditions that favor the spontaneous ignition of the coal are, great exposure of surface, fine structure of the coal, piling in large heaps, and moisture.

There appears to be no doubt that the loss in the weight and heat-producing value of coal is very great, whenever it is exposed to the action of the atmosphere in large heaps, and it is better not to keep such a stock on hand as is done by many establishments. Aside from the loss in weight, there is a manifest deterioration in its heating power, occasioned by the liberation of much of the hydrogen, and the consumption of the bitumen modification of carbon. Coal freshly mined is more valuable as a fuel, and it is worth more per ton than the heaps that have been deteriorated by long exposure to the air.—*Scientific American.*

[Our contemporary deserves our thanks for calling attention, as above, to a subject of much interest and importance to gas men. The present writer has long believed that the oxidation and slow combustion, so liable to pass into rapid combustion, of many coals in the air, was due almost, if not altogether, to a secondary agency of the contained pyrites, or rather of the ferric sulphate formed by its oxidation, which acts very appreciably upon the bituminous constituents. This view is a direct corollary from his own *Ceemical Theory of Coal-Genesis*, a sketch of which he gave on the 10th of January of this year to the New York Lyceum of Natural History (see this Repertory, No. 22, Jan. 17, 1870). According to this theory, coal together with the accompanying pyrites and ferrous carbonate (iron-stones) was produced by metamorphoses of organic matters in water charged with ferrous sulphate. Hence strata containing iron in ferric forms, like red and brown sandstones, seldom carry coal. And when the product of a ferrous epoch coal is exposed to an oxidating atmosphere, like our own, ferric sulphate are produced, incompatible with the coaly matter.

Henry Wurtz.]

Boiler Explosions.

The report of the Midland Steam Boiler Inspection and Assurance Company, for 1869, contains, among much other very interesting and instructive matter, the following paragraph, which we commend to the earnest attention of those who believe in the "inexplicable power" of steam.

"It is observed with regret that boiler explosions are still attributed by those who have given little attention to the facts of the cases to mysterious causes, such as electricity, decomposition of water, explosive gases, etc., and it is believed nothing will better convince those responsible for boilers of the simple causes which

lead to explosion, and the easy means of preventing them by due care or inspection than accurate records of those boilers which have exploded."

Now what is the record. From corrosions 16 out of 39 boilers reported exploded. From *over repairs, patch upon patch*, 12 went up. Low water caused the destruction of 8. Weak tubes without strengthening rings brought eight more to grief. Want of stays caused the ruin of four. Weak man hole without strengthening rings brought to an untimely end three more. One only is reported as having blown up from extraneous causes, and seven are reported as bursting from unknown causes, or from causes of which no trustworthy particulars could be obtained.

We once heard of an individual of limited education who, when in reading he chanced to stumble upon a long word, escaped the difficulties of pronouncing it by calling it "sundries." So it has got to be the fashion among those who are always ready to philosophize upon what they really know little or nothing about, to charge the explosions of all boilers, of which the causes are unascertained, to an inexplicable force, which covers ignorance of real or probable causes.

There seems a tendency in the human mind to look for supernatural rather than for natural causes of events, and this tendency only diminishes as people become educated to analyze complex occurrences and trace effects to causes. But even with those who are thus educated, there seems to be a charm in a search for some hidden, though it may be natural cause for a phenomenon, so that in their endeavor to detect the remote, they overlook immediate causes altogether.

Now, if instead of looking so far for occult forces, owners of steam engines would look for defects in boilers, and not content themselves with once looking, but continue on the lookout for defects that are constantly liable to occur, they would show far more wisdom and suffer less damage.

The appendix to the report alluded to states that the most prevailing evil has been that of "seam ripping where cracks extend from rivet to rivet, until too little sound seam is left to retain the boiler whole. About thirty very dangerous seam rips have been discovered, besides many others where the mischief had commenced." Bad iron, bad workmanship in not matching rivet holes, so that the strain of expansion and contraction has caused rupture, concentration of fierce heat on too small area, deposit of scale, and imperfect circulation consequent upon accumulation of mud, are the causes of this seam ripping.

The practice of expending money in patching and repatching, and putting patch upon patch, instead of renewing the boiler, is deprecated in strong terms.

The chief cause of corrosion appears to be small leaks, especially where the flues are difficult to enter, or where the boilers are so covered that the leaks do not show. —*Exchange.*

Amalgams.

When the cohesion of a metal is slight, as in the cases of potassium and sodium, or when its affinity for mercury is considerable, as in the instances of gold and silver, amalgamation takes place readily, by mere contact. When, on the other hand, the cohesion of a metal is strong, or its affinity for mercury is weak, heat or intermediate action, or both, are requisite to effect amalgamation. If forty-four parts of mercury be mixed with one of potassium, combination occurs with the evolution of much heat; and when the resulting amalgam is cold, it is hard, and has the appearance of silver. When the quantity of mercury exceeds one hundred parts to one of potassium the compound is liquid, and an amalgamation containing only 1-5 per cent. of potassium is susceptible of crystallization. The density of an amalgam exceeds that of the mean of the metals; this, and the tendency of one or both metals to oxidize, are additional indications of chemical combination. There are some metals it has been observed, requiring heat to amalgamate them. Antimony offers an example of this; to effect combination it must be melted, and, when liquid, mixed with hot mercury. Mere heat, however, causes scarcely any action between iron and mercury; they may be amalgamated by mixing the filings of the metal with powdered alum, and rubbing them together in a mortar with a little water. After trituration the alum may be washed out. By the intervention of tin or zinc, iron may be combined with mercury, and a double amalgam is formed. Platina also unites with mercury, by the intervention of the amalgam of potassium, but not by direct action. The double amalgam of iron and zinc does not rapidly undergo any change, and is not attracted by the magnet. All amalgams are decomposed by a red heat; the mercury being distilled, and the more fixed metal remaining. The process of amalgamation and decomposition is employed to separate gold and silver from their ores. The mercury obtained by decomposing the amalgams is distilled, and repeatedly used for the same purpose, with comparatively little loss. The amalgams of gold and silver are used or employed in the process of gilding and plating. We have also shown the amalgam of tin is largely used in what is called silvering mirrors, and that various amalgams of tin and zinc are employed for exciting electricity in the machine.—*British and Foreign Mechanic and Scientific Instructor.*

Preservation of Cast-Iron Water Pipes.

In 1858 the cast-iron pipes carrying the Cochituate Water from Boston to South Boston, were treated with a preparation from coal tar, known as Dr. Smith's process, and the result has been so favorable that it has been permanently adopted by the Cochituate Water Board, and by the managers of other water works throughout the country, where the material used for pipe is cast iron. The pipes laid in 1858 were taken up and examined after ten years' use, and were found nearly free from rust or ocherous accretions. This coal pitch varnish is applied substantially according to Dr. Smith's process, which is described as follows in the specifications:

Every pipe and casting must be entirely free from dust, sand, or rust, when the varnish is applied.

The varnish or pitch is to be made from coal tar, distilled until all the naphtha is removed, the material deodorized, and the pitch reduced to about the consistency of wax or very thick molasses; pitch which becomes hard and brittle when cold will not answer for this use.

Pitch of the proper quality having been obtained, it must be heated in a suitable vessel, to a temperature of 300 deg. Fah., and must be maintained at not less than that temperatnre during the dipping. As the material will deteriorate after a number of pipes have been dipped, fresh pitch must be frequently added, and at least eight per cent of heavy linseed oil must be added daily with the pitch, and the vessel must be entirely emptied of the pitch and refilled with fresh material as often as may be necessary, to insure the perfection of the process.

Each casting shall be kept immersed from thirty to forty-five minutes, or until it attains the temperature of 300 deg. Fah., and, if required by the engineer, shall be heated to such temperature as he may designate before it is dipped.

After the bath is completed, the castings will be removed and placed in such a position to drip, that the thickness of the varnish shall be uniform.

The coating on the pipes and castings must be tenacious when cold, and not brittle, nor disposed to scale off, and when it shall appear to the inspector that the coating has not been satisfactorily applied, the pipe or casting shall be thoroughly scraped, cleaned, and recoated.—*Scientific American.*

Monthly Report of the Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections for the month of April:

During the month, 473 visits of inspection were made, and 930boilers examined, 726 externally and 325 internally, while 92 were tested by hydraulic pressure. The number of defects in all discovered were 474, of which 49 were regarded as dangerous. The defects in detail are as follows: Furnaces out of shape, 16. Fractures in all, 25—9 dangerous. Burned plates, 29—2 dangerous. Cases of incrustation and scale, 110—4 dangerous. Cases of external corrosion, 21—6 dangerous. Cases of internal corrosion, 14—2 dangerous. Internal grooving, 7. Water-gauges out of order, 31—2 dangerous Blow-out apparatus out of order, 12—2 dangerous. Safety-valves overloaded, 26—3 dangerous. Pressure-gauges out of order, 92—6 dangerous; these varied from —44 to +23. Boilers without gauges, 2—1 dangerous. Cases of deficiency of water, 1. Broken braces in 15 boilers—4 dangerous. Loose braces in 12 boilers. New tubes ordered ie 2 boilers. One boiler condemned as beyond repair.

"Neglect to keep fire-sheets clean, and urging fires too fiercely, have shown their effects in distorting and fracturing furnace sheets. The tendency to overwork boilers cannot otherwise than produce such results. If boilers were supplied with accessible *hand holes*, and care taken to remove all deposit frequently, as well as working the fires moderately, our reports would be nearly free from cases of burned plates fractures, and furnaces out of shape.

"Much of the iron put into boilers is entirely unfit for use. We have recently examined a piece cut from a plate which was composed of no less than five distinct leaves or laminations. Such iron cannot otherwise than blister, and the whole structure will be weak and unsafe. Every sheet before being used should be most carefully examined with a view to detect flaws and weak places.

"External corrosion arises from leakage at blow out, or leaky seams, especially around patches; the joints of fittings are not always tight, and a little water between boiler and brick casing in time will do serious damage, hence we not unfrequently find portions of sheets corroded so thin that a light blow of the hammer entirely penetrates the iron. Boilers set low down in damp places, or subjected to the drippings of water from leaky joints in pipes or from leaky tanks, are liable to this trouble.

"We briefly call attention to the great number of inaccurate steam gauges, varying from—45 to+23. It is all important that these gauges be often examined and tested, and engineers should see that they are. It is part of their duty to attend to such matters; neglect to keep all-important appliances in good condition should be evidence of inability."

Sinking the Caisson for the East River Bridge.

The first step of progress in the actual building of the East River Bridge may be said to have been taken upon the occasion of the caisson, which goes to form the foundation for the stone pier of the bridge upon the Brooklyn side, being placed in position, and lowered into its final resting-place. The caisson, which has lain at Greenpoint since its launch, was towed to Dock street, and arrived at the pier one block above Fulton Ferry at 10 o'clock on the morning of Monday, May 16th. It was brought down by the steamers Virginia Seymour, T. E. Babcock, Schultz, Titan, N. B. Starbuck, and Seth Low, all being 280 horse power. An immense crowd of spectators had gathered to see the arrival of the monster caisson at its final destination. There were a number of distinguished visitors, who remained upon the monster while it was being placed in position. Among these were Captain John Maginn, the veteran Sandy Hook pilot, who piloted the caisson down the river; Messrs William C. Kingsley, Superintendent of Construction; Colonel W. A. Roebling, Engineer-in Chief; Horatio Allen, Consulting Engineer; Hon. H. C Murphy, Hon. J. S. T. Stranahan, John H. Prentice, C. C. Martin, Assistant Engineer; Colonel Paine, Assistant Engineer and Constructor; Dr. S. Rule, Inspector; Mr. Bell, of the firm of William H. Webb and Bell; T. C. Douglass, Master Mason; Daniel Hart, Harbor Master; and other well-known citizens.

The difficulty of getting the caisson into position proved to be not so great as was anticidated. Everything moved along smoothly, and the ardnous undertaking of placing it in the final position was effected without the slightest confusion or damage. The work was done under the general supervision of Henry C. Murphy, President of the East River Bridge Company, and John A. Roebling, Chief Engineer of the same. By half past eleven o'clock nothing more remained to be done. The caisson is one hundred and seventy feet long, one hundred and two feet wide, and eighteen feet deep. The material of which it is made is yellow pine, filled in with concrete, one floor rising above the other. Its weight is two thousand eight hundred tons, and, taking into consideration that over three million five hundred feet of oak and pine lumber were used in its construction, it may be very correctly described as a huge, oblong mass of timber. Ten feet more of timber are to be laid on top, after which the mason work will be begun. In the meantime, iron pipes with ladders inside will be sunk, which will enable men, by the aid of an air pump, to descend and dig. As fast as the mason work is laid, the caisson will sink until it is completely embedded in the earth, where it will probably remain for centuries. Building operations will soon be commenced. There will be three gangs of one hundred and seventy-five men each employed to go down the pipes. They will excavate within the caisson until it is by this process sunk from thirty to fifty feet deeper than at present. Everything connected with the building of the bridge will be pushed forward rapidly.—*New York Star.*

The rise of waters in the Mississippi this spring is unprecedented in the annals of history. From St. Paul to New Orleans come accounts of the immense flow of waters, and the end is not yet. Between St. Paul and St. Louis, every town not located on some bluff is inundated with water, and the damage done thereby is counted by millions.

Correspondence.

[Correspondents in all cases should sign their communications with their names and address in full, not necessarily for publication, but as a guarantee of good faith.—Eds.]

Strange Freak of Lightning.

ZANESVILLE, May 23, 1870.

Messrs. Editors: I send you an account of another strange freak of lightning, which proves to my mind the utter uselessness of lightning rods as generally constructed. This case may have some bearing on the controversy now going on in the GAS-LIGHT JOURNAL, on lightning rods. The drawing enclosed shows the south or rear end of a brick cottage dwelling, 42 by 30 feet, with two twisted copper ribbon lightning-rods attached, and some twenty-four feet apart, and projecting some eight feet above the roof. They are called the "Improved *patent tipped* lightning-rods." The said cottage was struck by lightning on the morning of the 21st inst. The dark shaggy lines on the roof show the damage done by the lightning, and with that exception there is not a visible mark of any other damage done inside or out; neither is there any signs of where or how the fluid left the building. The cottage stands (isolated) on the bank of the river, some 50 feet above the water. The rods enter some six feet into soil composed of sand, gravel, and some loom on the surface. Perhaps you or some of your readers can explain the above satisfactory. I cannot.

Yours respectfully,
A. C. Ross.

New Geological Views.

A writer in a late number of the *Edinburgh Review* sums up the latest phase of geological science, comprising some sublime and certainly strange views. First, the new geology finds that the sun is made of the same materials as the earth, but is on fire. It is a "great fiery globe surrounded by an atmosphere of intensely-heated gases and vapors, that are continually rising or falling, like our clouds, according to their change of temperature." Flames of burning hydrogen flare out seventy or ninety thousand miles beyond the dazzling atmosphere of light. Second, the stars, so far as they can be examined, yield similar results as to the materials of which they are composed. The nebulæ are made up, some of remote stars, but some chiefly of such well-known gases as hydrogen and nitrogen. Third, the planets generally resemble the earth in form, in solidity, in atmosphere, in their general relation to the sun and his system. Mars, for instance, is whitened in every one of his long winters, over all the polar regions, by heavy falls of snow, which melts away again in summer. Fourth, meteorites, which are small planets turned out of their course, have disclosed at least twenty-seven of the elements found in our own rocks.

It is, moreover, held that the earth was once a molten ball, a source of light, like the sun. It has cooled off, and is cooling still. The sun too is cooling; its vast size makes the process slower; but the result is inevitable, and it will one day be what the earth is now. On the other hand, the earth and other planetary bodies are surely, though so slowly, gravitating toward the sun, and, says Sir William Thompson, "not one can escape its fiery end." Will that be an end, however, since neither matter nor force is capable of destruction? To resume the general theory, the writer says:

"The inevitable conclusion derived from the study of the heavenly bodies—of sun, rarth, stars, meteorites and nebulæ—is that the immeasurable space is full of matter of the same kind, but aggregated in different fashions; sometimes being gaseous, at other times solid, sometimes in a state of the most intense heat, at other times cooled sufficiently to admit of the presence of life, as in the Earth and Mars, or lastly, cold, barren, and lifeless, as in the meteorites. Whether the gaseous condition of matter preceded in any particular case, the solid, we cannot tell. So far as our earth is concerned, the only idea that we can grasp of its origin is that it was a fiery body like the sun, and that it has been gradually cooling from that time down to the present day. This realiznion of the steady change is a fundamental doctrine of evolutionism."

The St. Louis Gas Company has sued the city for various sums for gas furnished the city during the past three years, aggregating over $800,000. This is regarded as an offset to a suit which the city counsellor will bring against the gas company.

Recent American Patents.

Pertaining to Gas, Water, Etc., from the 21st May to the 4th June, 1870.

103,011.—Lamp.—Abner Burbank, Rochester, N. Y., assignor to himself, H. S. Joy, and G. D. Williams.

103,017.—Gas Heater.—Joshua Cromley, Phil'a, Pa.

103,036.—Gas Generator.—T. B. Fogarty, New York city. Antedated May 12, 1870.

103,048.—Lamp Extinguisher.—John Hughes, New Berne, N. C.

103,059.—Steam Generator.—William Hartill Law, Birmingham, England.

103,076.—Steam Vacuum Pump.—J. H. Patee and G. H. Nye (assignors to themselves, H. J. Graham, and H. H. Patee), Monmouth, Ill.

103,087.—Steam Generator.—G. O. Sampson, Jamestown, N. Y.

103,120.—Steam Generator.—Dexter Amsdell, Hamburgh, N. Y.

103,127.—Apparatus for Lighting Gas by Electricity.—W. W. Batchelder, assignor to George Viles, Boston, Mass.

103,212.—Steam Engine.—H. E. Long, Decatur, Ill.

102,213.—Lamp Burner.—Wm. D. Ludlow, N. Y. city.

103,238.—Frame for Street Lamps, Etc.—Jacob Radston, San Francisco, Cal.

103,248.—Steam Generator.—William P. Skiffington, New York city.

103,279.—Rotary Steam Engine—John B. Bailey, New York city.

103,297.—Gas Heater.—C. C. Burt, Jackson, assignor to G. Herrick, Albion, Mich.

103,363.—Steam Generator.—Abraham L. Pennock, Philadelphia, Pa.

103,379.—Water Meter.—Gerard Sickles, Boston, Mass.

103,385.—Apparatus for Distilling Hydrocarbon.—H. A. Stearns, Smithfield, R. I.

103,392.—Gas Condenser.—Edward Thompson, Madison, Wis. Antedated May 14, 1870.

103,439.—Water Power Mechanism.—Abel French, Central City, Iowa.

103,465.—Machine for Generating and Carburetting Hydrogen Gas.—H. J. Hoyt, Norwalk, Conn.

103,475.—Water Wheel.—Jesse Krall, Hall, Pa.

103,513.—Water Wheel.—Henry W. Shipley, Portland, Oregon.

103,518.—Water Elevator.—Hatherly Spear, Cape Elizabeth, Me.

103,539.—Boiler Feeder and Low Water Alarm.—V. D. Anderson, Kewanee, Ill.

103,579.—Setting Gas Retort.—Thomas Curley, Wilmington, Del.

103,598.—Lamp Burner—Jim B. Fuller, Norwich, Ct.

103,613.—Water Elevator.—Morrison Heady, Spencer county, Ky.

103,640.—Steam Engine Connection.—Leonard Phleger, Philadelphia, Pa. Antedated May 19, 1870.

103,657.—Water Wheel.—Wm. W. Richardson, Chicago, Ill.

103,661.—Composition for Preventing Incrustation in Steam Boilers.—J. G. Rogers, Madison, Ind.

103,662.—Preventing Incrustation in Steam Boilers.—J. G. Rogers, Madison, Ind.

103,684.—Rotary Pump.—Thos. Swan, Manlius, N. Y.

103,690.—Low Water Indicators for Boilers.—Chas. S. Watson, Philadelphia, Pa. Antedated Jan. 29, 1870.

1x3756.—Steam Pump.—W. Livingston (assignor to John Roach), New York city.

103,793.—Steam Generator.—Charles Spring, Hyde Park, and Andrew Spring, Weston, Mass.

103,794.—Turbine Water Wheel.—Bradford Stetson, Uxbridge, assignor to himself and Elmer Townsend, Boston, Mass.

Artificial Light.—When the products of the distillation of coal were first proposed for purposes of illumination, the person who advocated it was set down as demented; nevertheless he carried his point, and those who opposed him proved to be the only crazy persons involved in the transaction. The light provided in this way is often of an inferior quality, and it has been proposed to add to its value by passing it through some volatile liquid near the point of consumption. The hydrogen of the gas takes up carbon and burns with a brighter flame. Recent experiments have been tried with other liquids than those popularly known, and the results have been so satisfactory, that hopes are entertained of being able to employ some of the new mixtures for photographic purposes. If we pass hydrogen through zinc ethyl, it takes up a quantity of zinc mechanically and burns with a brilliant flame.

If chloro-chromic acid be substituted for the zinc ethyl, some chromium is carried off with the hydrogen and the light is more brilliant than before, and is said to have powerful actinic properties. Chloride of titanium also produces fine effects, and if the research were to be continued other liquid compounds of the metals would be found to yield simple results. The chlorides of silicon and of iron ought to be tried. The results obtained appear to confirm the theory that the light comes from a colid incandescent substance in the flame, and hence a metal can be advantageously substituted for the carbon commonly employed.

Death of An Eminent Chemist.—F. T. Otto, Professor of Chemistry at the Polytechnic School of Brunswick, died on the 13th of January, after a long and painful illness. He was born in, Saxony, in 1809 and had resided many years in Brunswick. Professor Otto was famous for his edition of "Graham's Elements of Chemistry." At first he made a translation of Graham's book, but with each edition introduced so many changes that the last edition may be regarded as an entirely new work. There are few books so useful to the student in the laboratory as Otto's Chemistry. In the last edition he was assisted by Buff, Kopp, Zamminer, Klobe, and Fehling, the best lights of chemistry in Germany. Otto also publihed books on poisons, on vinegar, and agritultural industry, which are highly prized.—*Journal of Applied Chemistry.*

Gas Furnaces.—At a recent meeting of the Iron and Steel Institute, held in London, among various subjects discussed, we take the following in relation to gas furnaces:

From the great movement in favor of using fuel in its gaseous instead of its solid form, the discussion of Mr. Benson's paper "On the Generation of Combustible Gases under Pressure" was looked forward to with much interest. With regard to the quantity of fuel used to produce a given quantity of heat, it is, probably, admitted generally, that the use of it in the gaseous state is not so economic, but against this there are advantages which far more than balance any want of economy. Mr. Benson's object was to describe an improvement upon Mr. Siemens' furnace, which he had devised; and although Mr. Siemen regarded Mr. Benson's furnace as somewhat complicated, it has, probably, some advantages, which will secure its extensive adoption. The advantage of putting the fuel into gas before using it is that it can be more readily purified, and that a much higher temperature can be obtained without draughts. When Mr. Benson commenced experimenting he found that a high pressure could not be used: the pressure in the generator he now described was only enough for the pressure in the furnace. The advantage of his arrangement was that you could obtain all the results sought, and could use caking as well as non-caking coal.—*London Min. Journal.*

FOR SALE.—THIRTY THOUSAND POUNDS of Retort House Castings, making six Benches of Threes, including everything, from the Ash Pans to the Hydraulic Main. The Connections are six-inch and the Hydraulic Main twelve, in good order and but little worn.

We can also sell three Iron Retorts (new) and one setting of New York Tile, at less than cost; or will exchange the whole for three, four and six-inch pipe.

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251-tf Sec. Nashville Gas-Light Company.

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PROFESSOR HENRY WURTZ.

[NOTE BY PROFESSOR WURTZ.—Contributions and items for which I am, as a Scientist, individually responsible, will have attached my full name or initials.—H. W.]

THURSDAY, JUNE 16, 1870.

WISHING TO MAKE this Journal an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of those subjects a pleasure, or a profession.

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THE MURPHY RUN COAL.

In the last issue (page 168) was given a report of a complete analysis by the undersigned of the gas now made by the HARLEM GAS-LIGHT COMPANY, from this excellent West Virginia coal. This gas-analysis was made with a degree of care and thoroughness which has seldom been applied to such analyses in this country. In fact our information regarding the chemistry of gases made from *American* gas-coals is lamentably meagre, such analyses as have been made (chiefly by the older and ruder methods in use before the time of BUNSEN) having been rarely published. This analysis of Murphy Run Gas may be pointed to as an illustration of what will be accomplished, in the way of interesting and suggestive information, available to the profession, in this country, whenever we shall have numerous such analyses to compare and to generalize from. Strongly realizing this, and being now in possession of facilities for making such analyses probably unrivalled in this country, and having had much experience in such work, the present writer will endeavor to the best of his opportunities to supply this deficiency; and may here add that he is now engaged upon other similar analyses, whose results will be of great value and interest. Of course but little can be expected to be deduced, of general applicability, from analyses of a few isolated samples; as to any peculiarities of composition of the gases from the great multitude of gas-coals we possess, which would guide us to practical modes of combining diffierent coals to produce any desired results. Such can only be expected from a multiplication of analyses. The writer therefore appeals to Gas Managers generally, for co-operation in his undertaking, and will be pleased to correspond with all Gas Engineers and gentlemen interested in American Coals, upon this and related subjects.

With regard to the Murphy Run Gas, a few remarks may be thrown out now, in advance of a more extended discussion hereafter. The extremely low proportion of *carbonic oxide* seems to indicate that one peculiarity of Monongahela Valley coals, if not of other American caking coals, may be found to be a lack of oxygen in the "bituminous" constituents of the mineral. In connection with this I would refer back to the analysis published by Professor SILLIMAN and myself of the New Haven City Gas, made chiefly from Pennsylvania Westmoreland Coal (see this Journal, March 2, 1870, page 67), which gave but 2.13 p. c. of CO. Albertite gas, however, was here a constituent of the product analyzed. We have indicated here the importance of *elementary* organic analyses of our American coals, to enable us fully to know and understand them; a class of analyses which, so far as my knowledge extends, is wanting, absolutely without exception; at least so far as *publication* goes.

The volume of *illuminant hydrocarbons* in this gas is remarkably low for so high a candle power. It seems to point to an unusual degree of density on the part of these hydrocarbons, a point which will be settled by density determinations of the gas, before and after the separation of the illuminants. This investigation is in progress, but not yet completed. In the mean time, we have another striking confirmation of the fallacy of the old notion that the candle power may be deduced from the volume of hydrocarbons capable of absorption by bromine, Nordhausen acid, etc.

The proportion of carbonic acid in the Murphy Run Gas is interesting in connection with the candle power. In the issue of this Journal of April 16, 1870, page 121, the very little that is known on the subject of the ratio of degradation of candle power by carbonic acid is explained. In the results there quoted from ALEXANDER WRIGHT, who operated, however, on a gas far richer than this, which gave over 20 candles with a four-feet Argand, there was found a deterioration, for each one per cent. of carbonic acid, when not more than 1.5 per cent. was present, of 6.7 of the candle power.

Luckily, I have the result obtained, in an experiment on a working scale, by another gentleman, upon Murphy Run Coal; in which the gas was carefully purified by *lime*, and in which therefore it may be supposed that the 1.17 per cent. carbonic acid left in the gas, according to my analysis, by the iron, must have been taken out. The result was 4.42 feet of gas per lb. of coal carbonized, of 20.25 candle power. The HARLEM COMPANY obtains 4.55 feet of 18 25 candles. This indicates a degradation, with a five-feet consumpt, for each one per cent. of carbonic acid, of 6.1ϕ per cent. of the candle power, a *calculated* fignre which is remarkably close to the actual experimental figure of WRIGHT; but which points to the conclusion that the relative degradation may decrease with the consumption. More of this though again.

HENRY WURTZ.

QUALIFICATIONS NECESSARY TO CONSTITUTE A SUCCESSFUL GAS ENGINEER.

In view of the increasing number of gas works in this country, and the growing attention which is paid to the subject of artificial illumination, the question of—What are the qualifications necessary to constitute a successful gas engineer? is one of vast importance; and in considering it, it will be necessary to regard the nature of the duties connected with the superintendence of the manufacture of gas. It would be a matter of impossibility in our limited space to enter into any details of the various requirements which should be possessed by a thorough engineer. We can but briefly reflect on the more promineut points of interest which present themselves, and take a hasty glance at the several sciences, some of whose laws are observed in the familiar operations of the gas works.

As the generation, condensation, and purification of gas are essentially chemical operations, it follows that some knowledge of the principles of chemistry should be understood, so as to offer an intelligible solution to these otherwise mysterious processes. To the unitiated it seems a perfectly simple matter to place a charge of coals in a retort, and to conduct the resulting gas through the hydraulic main, washers, condensers, purifiers, etc., and so on to the holders; and they would see very little necessity for any scientific information. If with different kinds of coals, and in all kinds of weather, these operations progressed uninterruptedly, perhaps no great amount of erudition would be requisite: but it must be remembered that afterwards circumstances will occur, which are enough to perplex the most skilful engineer, and to occasion no inconsiderale degree of study as to their probable cause. It is in times like these, if at no other period, that chemical knowledge is required to account for the anomalous actions and to offer a reason therefor. This, however, is but one instance; numerous others might be mentioned where some knowledge of the principles of chemistry would be necessary. It must be apparent to the minds of all candid persons, that an operation based entirely upon chemical laws must be conducted by one having some information of the science.

The manifold processes connected with the manufacture and distribution of gas render a certain knowledge of the *rationale* of mechanics indispensable; and as this is an exact science, fortified by figures and rigid laws, an acquaintance with it pre-supposes some familiarity with mathematics. Indeed, these sciences play a very important par

in the minutiæ of gas-making, and one who has not aptness in mastering their details, can never rely on becoming an expert engineer. A mere glance at any practical treatise on the art of gas generating, will afford ample testimony of the fact: and it cannot be ignored. Take for example the theory of the distributon of gas, and the principles regulating its flow through the mains and smaller pipes. It will be seen that these operations, which take place with a beautiful regularity, are clearly defined by certain laws: and in order to properly comprehend these laws, considerable mathematical information is requisite.

The frequent repairs which are necessary to be made in gas works, render a knowledge of mechanical trades of some importance. A competent engineer must be somewhat acquainted with the art of building, and should be able to furnish proper designs for enlargements and construction. Within the past few years many new and improved plans for the construction of retort houses and other parts of gas works have been devised, and these have been principally the result of the study and experience of intelligent engineers.

A gas engineer should thoroughly understand the principles and operation of the gas-meter in all its details. Too much stress cannot be laid on this point; for this instrument being the sole arbiter between the producer on the one hand, and the consumer on the other, is often the subject of dispute and doubts as to the accuracy of its registration.

Probably more complaints are made to engineers on account of fancied errors attributed to the meter, than to any other cause. In order to give an explanation of these apparent and generally imaginary discrepancies, it is absolutely indispensable to possess an accurate knowledge of gas-meters, and to be able to discern any irregularity or incorrectness in their indications.

There is another subject which many engineers are apt to ignore, but which, nevertheless, should receive its due share of attention. We refer to the daily use of the photometer as a matter of justice to the consumer, whereby he might be able to satisfy himself of the quality of the gas he pays for. The science of photometry has received too little consideration from gas engineers in this country; and it is time that a reform was inaugurated. We have heard some indications of an advance in this respect recently, but the reform is by no means as rapid as the importance of the subject demands. In order to obtain unvarying results in photometrical experiments, it requires careful manipulation and an experienced judgment. These points should be familiar to gas engineers, and apart from other considerations, a desire to be perfect in all the details of the profession, should be a strong incentive to efficiency in photometry, as well as in the more familiar branches of the art of gas-making In addition to the requirements already ennumerated, an expert engineer should possess some practical information regarding gas-fittings and burners, which are too little understood.

A number of other minor matters might be instanced, in which it would be well for a superintendent of gas-works to be versed in, but as intimated before, we can take but a rapid glance at the subject, and do not pretend to treat it in detail. It may be stated that as various establishments throughout the country are under charge of workmen who have no knowledge of the sciences above referred to, no education is requisite, and that a certain amount of practical experience only is needed. We are aware that many small works in villages are managed by unskilled laborers, who conduct the operation to the satisfaction of all parties concerned. This, however, is no argument against the trnth of what we have urged. A common sense view of the case proves the contrary. Gas-making is a a complex operation, involving the principles of various sciences, and it is plain that one who would be a proficient in his calling must be well grounded in his qualifications As an evidence of this we can point to numerous engineers in several of our large cities and elsewhere, whose success in their profession is second only to the liberal amount of varied information they bring to bear upon the minutiæ of their operations, and who have attained their present eminence by minute attention and close study of even the most unimportant details of the manufacture of gas.

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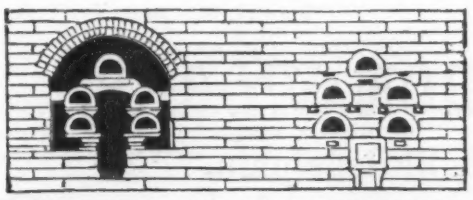

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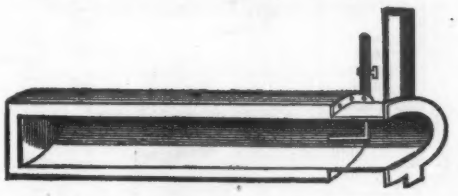

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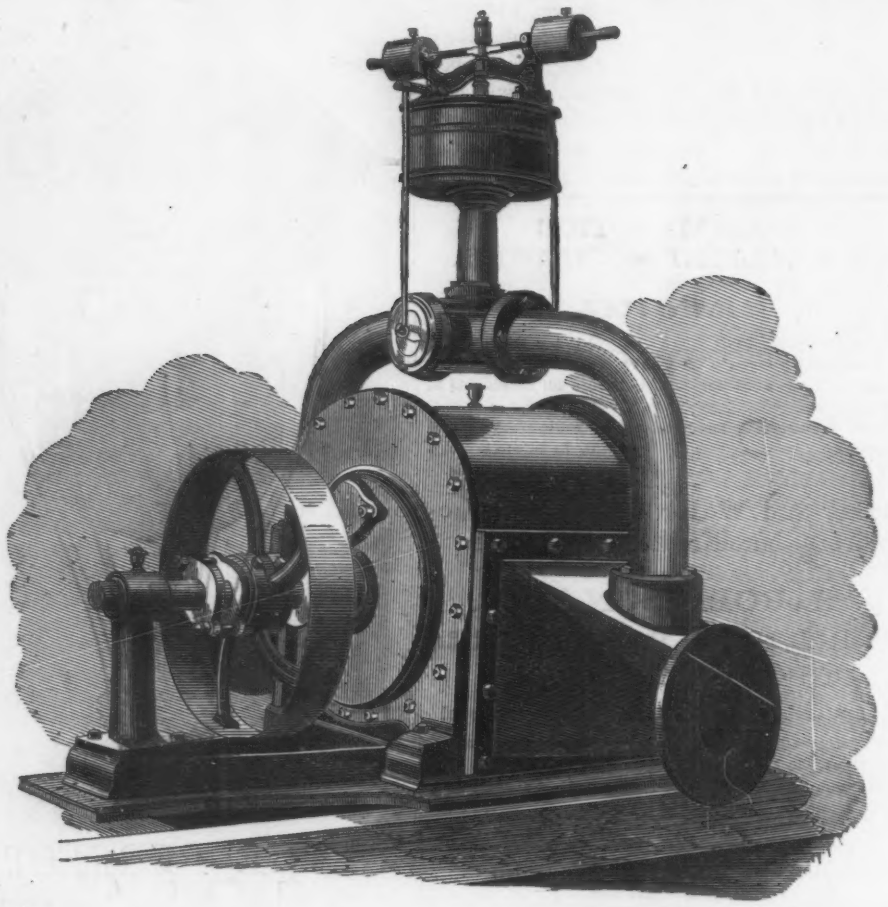

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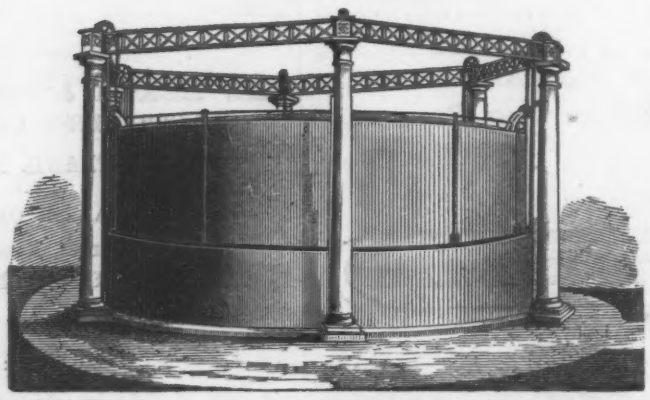

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FIG. 1.

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Fig. 2 represents wedge and one-half of gate of double valve, intended for larger sizes, when required to bear heavy pressure either side.

Fig. 3, represents a section through body, gate and wedge.

The slides, G G, are held against wedge D, by ribs, H H, projecting from sides of valve body, A.

In closing the valves, when opening I is covered, slides, G G, pass the lower ends of ribs, H H, when the wedge, D, can move forward on the inclined planes E E, and crowd the gates apart.

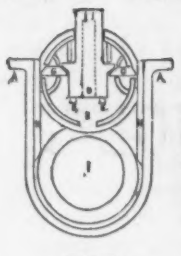

FIG. 3. FIG. 2.

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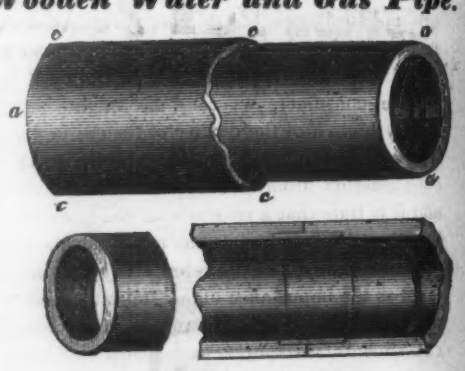

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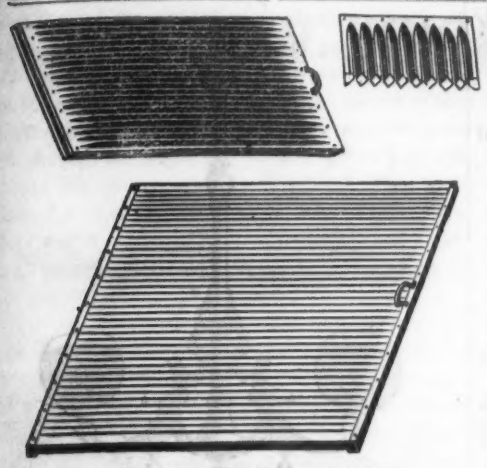

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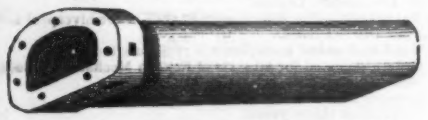

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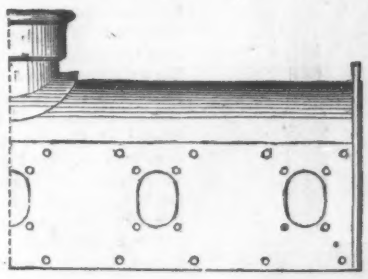

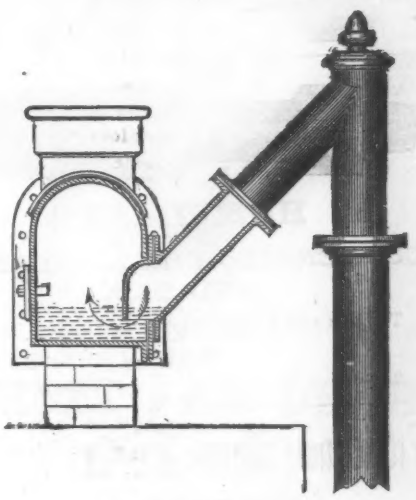

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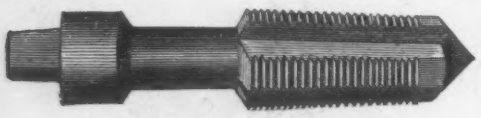

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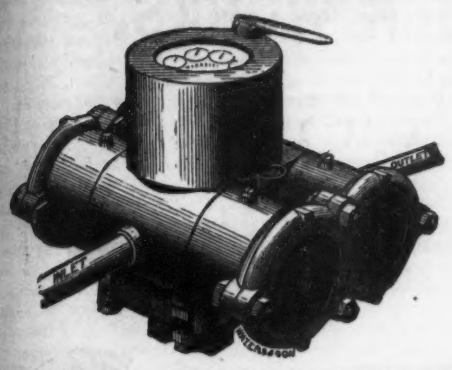

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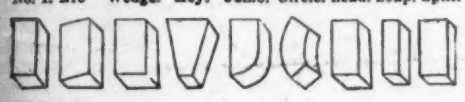

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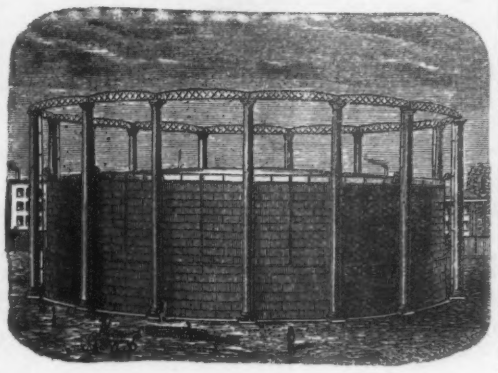

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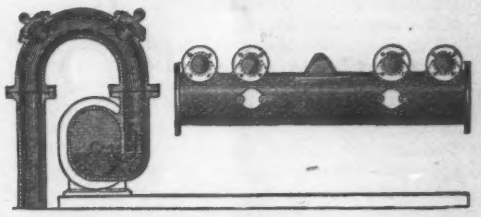

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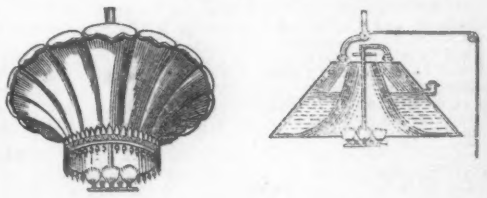

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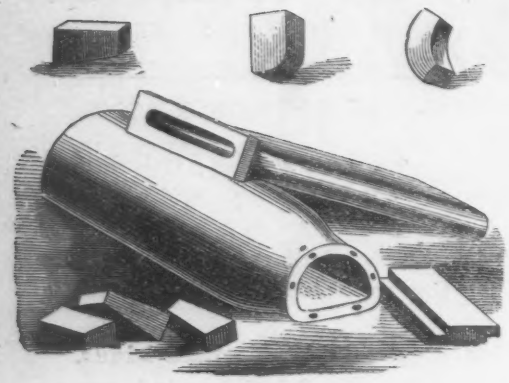

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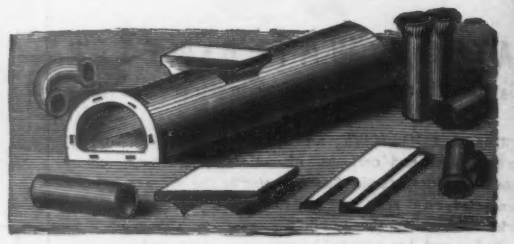

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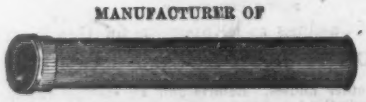

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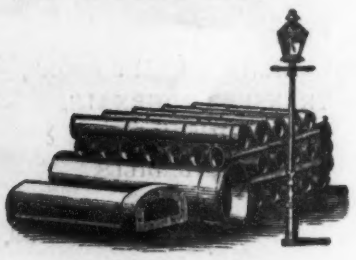

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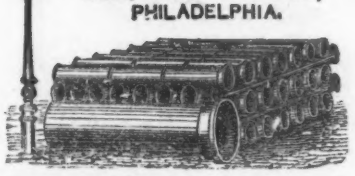

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